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INTEGUMENT—THE HIDE IN SEEKING*

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One year ago, Dr. Irvin Blank (1), in his presidential address before this Society spoke of cutaneous barriers, the properties of the skin which protect the organism from its environment, maintain it in relative isolation, and which in consequence in many ways insulate it against outside influences. He also spoke of the intangible barriers of dermatology, properties of the specialty which tend to maintain the discipline of dermatology in relative isolation, and in consequence insulate it against outside influences. In turn, on this occasion of the presidential address, it is my intention to talk of the skin as a highly functional intercommunicating and interrelating medium which mediates an intimate relationship of the organism with its environment. I wish also to direct attention to properties of the skin which similarly may be operable to induce dermatology into greater functional identities in interdisciplinary environments.

Casual wonderment over connotations of the skin to man—actual, implied or symbolic—is provocative and invites us to at least give some thoughtful analysis to man's awareness of, and attachment to, his skin, for in many ways the bite of the bark seems more than skin-deep.

All biologic packages are contained in one or another kind of integumental wrapper. Perhaps we should begin with membranes, a subject rather feverishly popular now, since they represent the ultimate of integuments, the integument of cells, cell nuclei, mitochondria and other particulate cellular constituents, in addition to their usual functions as extracellular interfaces between cell populations comprising the various tissue orders. But we will not on this occasion deal with the ultimate in integuments since I would yet like to comprehend the penultimate of integuments, the integument of the whole organism.

We might first consider the unicellular animal, living as a self-contained independent unit, in which the integumental cell wall, although varying in complexity from one type of organism to another, serves as the device by which the organism relates to its environment. Whatever the nature of learning processes that might be identified in such organisms, the cell's exploration of the unknown must be entirely via the cell wall. Indeed, survival itself depends upon ingestion, directly through the integument, of food from the environment. Similarly mediated is recognition of organisms of same or different types; it might be added that this fundamental trait is found expressed by individual cells of multicellular organisms where events such as cellular aggregation and contact inhibition perform highly important functions in embryonic morphogenesis of organs and other component structures, and in post-embryonic morphogenesis, commonly but vividly occurring in healing processes where tissue orientations and alignments are restored out of anatomic chaos because of the capacity of cells to distinguish other cells as being same or dissimilar.

The integument of multicellular organisms becomes more complex in comparison to the simple external organ of the unicellular Protozoa. In the more primitive Metazoa, the beginning of integumental specialization occurs when the external integument invaginates to produce a simple cavity, the gut of coelenterates. In more advanced Metazoa, the internal integuments permit each organism to more selectively encounter its environment, though the fundamental communication between the organism and the outside world through its integumental interfaces remains the same. Exploration, sampling, and learning of its surroundings becomes more sophisticated since the organism can now explore food possibilities of environmental objects, and with the added facility to determine with its mouth parts special food attributes by those organisms with taste apparatus. However sophisticated the means of exploring the environment may seem to have developed, these prove to be of limited discriminatory refinement when it is realized the major diseases of the

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more adaptive of the Metazoa, man, to date have been environmentally induced.

Confining our thoughts to an analysis of the external integument as a major determinant of life and behavior of organisms, we see that its properties determine whether life of the organism is aquatic, amphibious, terrestrial, or aerial-terrestrial. The permeability of the skin of the frog and the earthworm, for example, is such that only environments providing relative humidities of 100% are compatible with continued life. The predominantly non-permeable integuments of other animals permit a primary land existence, with cutaneous tolerance limited to more intermediate relative humidities, and cutaneous intolerance with humidities either extremely high or low. The development of certain cutaneous appendages, namely the eccrine gland and the pilary system, have permitted tolerances to biologically wide temperature ranges. The development of feathers permitted aerial transportation for otherwise terrestrial animals, although this ability for flight was accomplished for some animals by specially constructed extremities or acral parts. Perhaps in the context of such appurtenances, the most gifted are certain birds such as the duck or goose, terrestrial animals capable of flight because of feathers, capable of swimming because of webbed feet, and capable of remaining buoyant in water because of a single large sebaceous gland, the products of which are used to lubricate the feathers in the preening process. The skin and skin appendages—hair, fur, vibrissae, feathers, cilia—provide a range of biologic instruments to sense and identify the environment and to serve the processes of learning and exploration. Although the efficiency of recognition is sometimes of a low order, and measurement of environmental characteristics usually comparative rather than absolute, biologic organisms including man know much of the world we live in and the world we relate to because of cutaneous information on heat, cold, characteristics of water and air, texture qualities, and so forth.

The integument takes on a new dimension of importance in the biologic world with the development of the brain. Animals with the facility of cerebration develop an awareness of the integument, an awareness that in some ways seems proportionate to their cerebral development. Differences in plumage or integumental coloration identify the sexes of most species, and demonstrative accentuation of these differences is often utilized in mating behavior patterns. But the importance of skin and its appendages seems to reach its highest level in man. Man seems consciously aware of some of this, although at varying levels of consciousness. We seem to be consciously *unaware* of much more, and this is disturbing because unawareness precludes understanding, and lack of understanding excludes control. There are important determinants of the integument on man's personal life, his social orders, cultural systems, and even relations among nations—determinants which may not be appreciated for their importance or magnitude perhaps because of the peculiarity that familiarity tends to breed contempt. That there is at least unconscious recognition of the skin as a sensitive factor in man's relationship to himself and others may be suspected from references to the skin contained in our everyday language. Inferences of this sensitivity are readily construed from analysis of common phrases as "under the skin", "skin creep", "goose flesh", "itching to go", etc.—phrases in which the skin expresses a number of restive impulses. Conversely, phrases such as "arm-in-arm", "warmth of a touch", "a gentle pat", and others testify to messages of reassurances cutaneously transmitted.

A review of the phylogenetic heritage of skin as the primitive medium of learning and exploration, the recognition that the skin today in our advanced civilization continues to serve such a role, and the realization that man's cosmetic preoccupations provide an infinite array of economic props and cultural mainstays in the life we know and pursue, requires that we try to assess better the nature of determinant forces of the hide in the seekings of man.

It seems we might identify more important forces by an analysis of the skin as a conveyor of unspoken communications. A number of cutaneous attributes quickly impart to the viewer multiple bits of information, which in the mind of the beholder are registered as a package that in turn is ascribed an immediate quality of evaluation of some kind and of some degree. Skin attributes which may be registered quickly include characteristics of color, texture, appendages and disfigurements. A momentary

glimpse of color may instantly convey racial identities, environmental exposures, occupations, emotions, and various states of trauma, life and death; texture quickly conveys age; and hair distribution conveys sex. Casual sampling of quick judgments made on the basis of impulses received from visual impressions of the integument suggest that the extent of these judgments may be more far-ranging than we generally admit. One may test this in a free-association experiment under suitable conditions, for example when one's mind is inclined to wander in a congregation. Here one views only the backs of heads of people sitting ahead, and from this view alone a flood of impressions may register instantly, to include not only race, age and sex, but occupation, income and even temperament and other personality traits. These impressions may be built on the basis of attributes other than those discernible from a rapid visual "snap shot" of an immobilized subject, and the impressions may not be valid. But first impressions are known to last and the fact is that we do make rapid skin-deep judgments of individuals and groups, where a complexity of information is transmitted by external appearances without benefit of a spoken word. There seems little doubt that such judgments may have even influenced decisions of whole societies.

The corollary to rapid judgments made of others on the basis of external features is man's awareness that others quickly make impressions and judgments of him, which any cosmetologist will readily verify. Parenthetically it might be noted that the tendency to assign the dermatologic ward to a sequestered segment of the hospital suggests that even physicians react to influences conveyed by the disfigured integument. But patients with skin disease in turn present to themselves what must be a distressful dilemma in how to view themselves and to relate to those about them in a skin-conscious world. I do not believe we have directed sufficient study of how dermatologic patients with severe destruction of their external image make their adjustments.

This leads us then to the subject of the skin in medicine. The skin's early influence on medicine came as a symbol of creativity, introduced by Asclepius who, according to recorded testimonies (2), perceived the impressive phenomenon of the snake shedding off its old skin and which he interpreted as the snake's ability to cast off old age and to return to youth. The identification with the physician's attempts to cast off disease of the infirm led to the adoption of the Asclepian serpentine symbol for medicine over 3,000 years ago, a symbol retained to this day. Since the time of Asclepius the skin has played lesser or greater roles in man's attempts to understand the nature of disease and its control, and in quests for knowledge in biology and medicine. The role of dermatology, as a medical discipline, has not always seemed to be in phase or in proportion to the skin's role, and indeed much has happened with the skin in recent history in which dermatology has had little involvement. An example of this is in oncology where the skin, but not dermatology, was primarily involved with explorations into the nature of cancer and its causes. The era of development of knowledge on neoplasia was initiated by the recognition of Percival Pott (3) of scrotal skin cancer in chimney sweeps. It is not surprising that the skin played such a main part in later studies of carcinogenesis, for skin cancer was easily detected in the skin because of its visibility, and the skin bore the brunt of man's encounters with carcinogens in his newly-created environments produced by industrialization. Why dermatology did not provide leadership in oncologic research is not readily answerable, except perhaps because of the fact that there were many skin afflictions other than skin cancer which constituted man's major diseases, *e.g.* cutaneous infestations by bacterial and animal parasites, infections identified with the skin such as syphillis, diseases recognized by their cutaneous manifestations, and deficiency states also recognized by skin changes. Whatever the reason, the fact is that much of cancer research has been involved with skin neoplasia, and most of this research on skin has been done by workers not identified with dermatology. Similar situations can be identified with other subjects, for example transplantation biology.

I would not wish to leave the impression that dermatology has been generally remiss in providing leadership in biomedical research, for this is not the case, and leadership has been provided in subjects such as mycology, spirochetal diseases, and immunology. I would, though, endeavor to stimulate a greater awareness and sensitivity on the part of dermatology

to areas of knowledge still in need of development and in which the skin provides a singular system to seek fundamental information that will enhance understanding of life processes beyond the skin. We need not be concerned whether such knowledge be immediately applicable to dermatologic problems, for all knowledge developed in the skin will be of dermatologic significance. The skin would seem to provide a likely system to extend understanding and knowledge in research so seemingly diverse as that concerned with developmental biology, cell control mechanisms and tissue interactions, membrane physiology, and even paleology. The latter may be particularly appropriate since much of the science of fossils deals with integumental imprints of both plants and animals, *i.e.* archaeointegumentology.

Where the hide will be found in the seekings of science in the future will be determined by scholars of the skin and their determination of the depth of the skin. But it would seem wise for dermatology today to encourage extending this depth by encouraging explorations of life processes through the skin and beyond the skin, and induce the discipline into greater functional identities in interdisciplinary environments. One thing seems certain, we should insure self renewal by the cutaneous processes of shedding the obsolete for the new and pursue creativity wherever it leads.

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